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EUROPEAN UNION

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Inspire Policy Making with Territorial Evidence

tecnalia Inspiring Business

ESPON-TITAN
Territorial Impacts of Natural Disasters

APPLIED RESEARCH

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2019/2021

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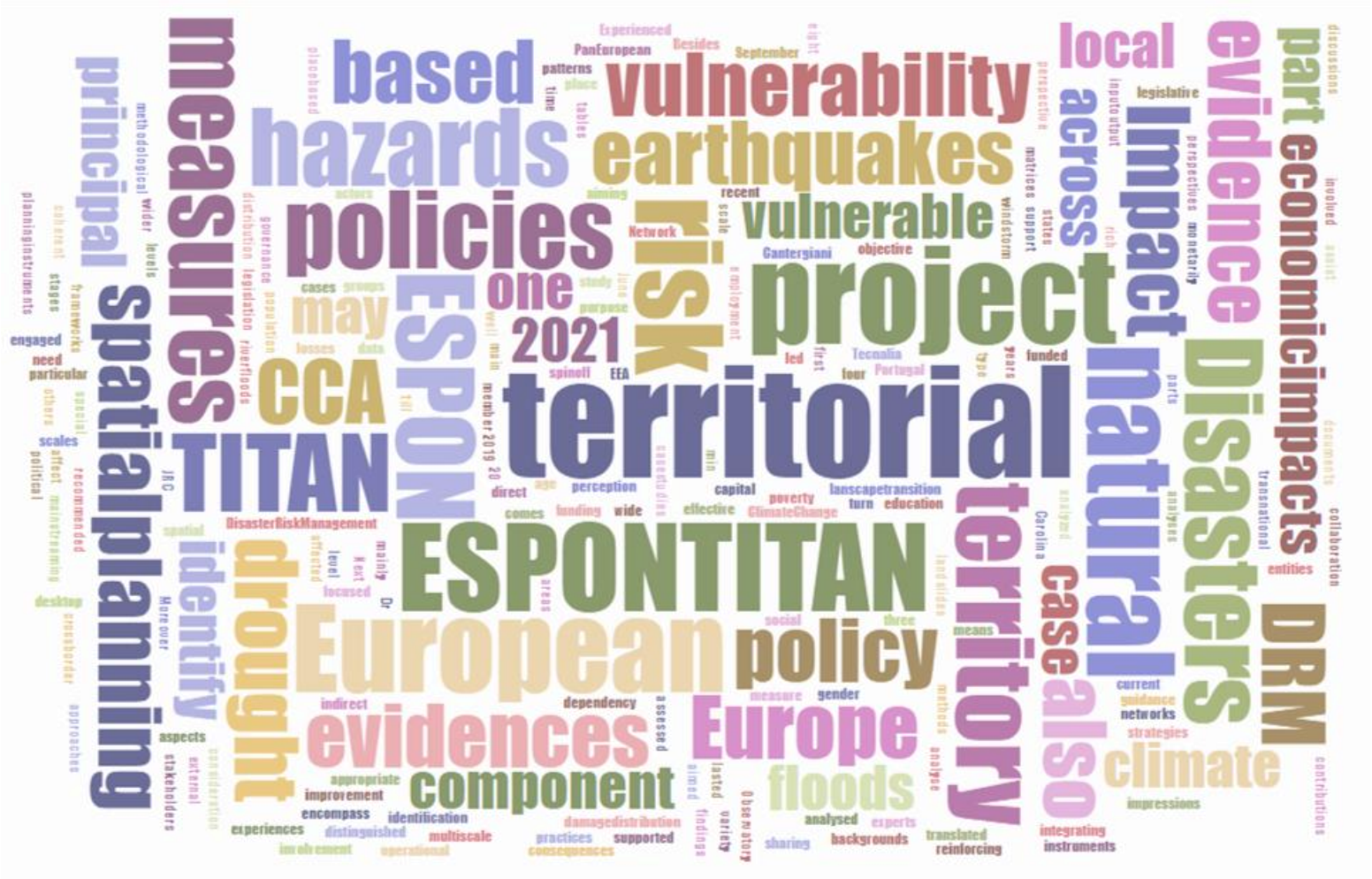
// ESPON-TITAN (framework)

1. ESPON-TITAN Scope



Natural hazards / Disasters

- The term “natural disaster” is erroneous (UNDRR, 2020)
- Hazards are natural; disasters are not (UNISDR, 2010)
- Earthquakes, droughts, floods, storms and landslides, among others, are natural hazards; they may lead to deaths and damages – i.e. disasters – because of human acts of omission and commission, rather than the act of nature (UNISDR, 2010)
- There is growing online campaign that advocates this idea under the slogan #NoNaturalDisasters
- this term may, inaccurately, still appear – even in official documents – as a synonym of “disaster caused by the combination of a natural hazard and vulnerable and exposed population”
- until some years ago it was widely used
- The title of this project/report could not be changed due to legal reasons

1. ESPON-TITAN

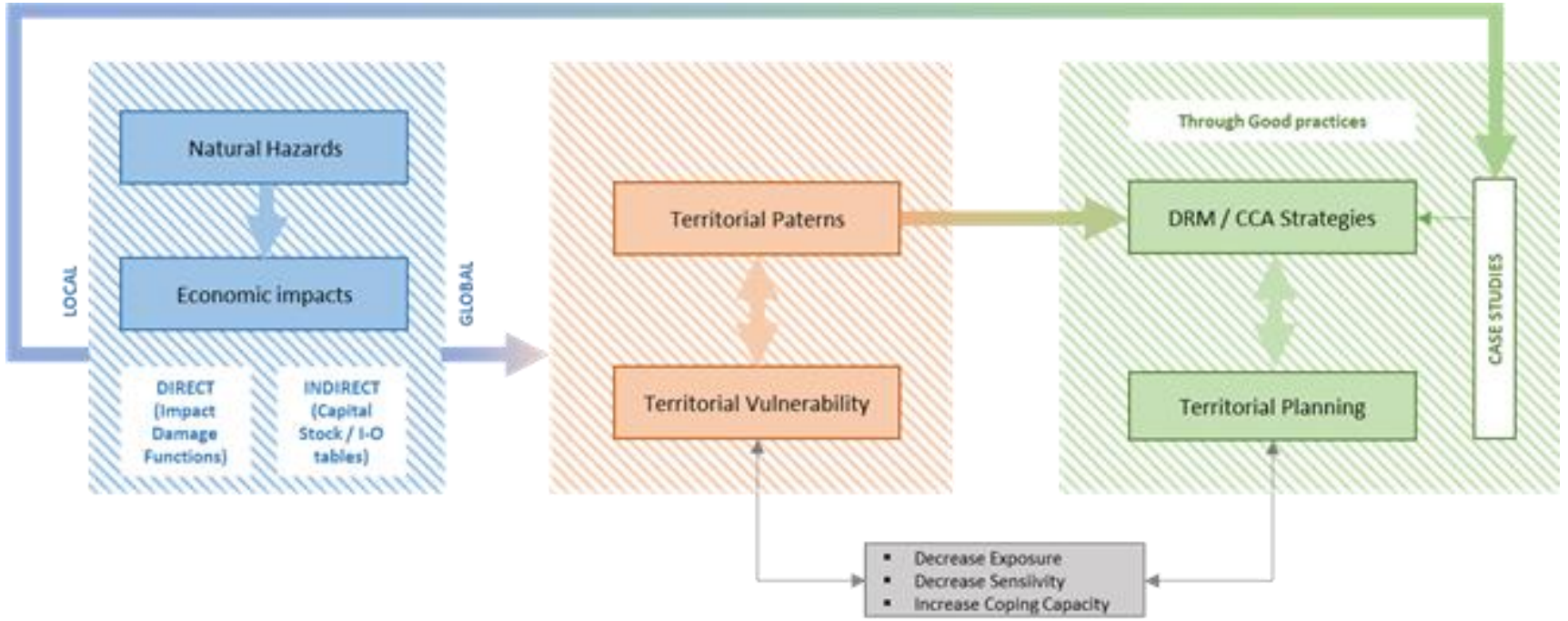
RIVER FLOODS

WINDSTORMS

EARTHQUAKES

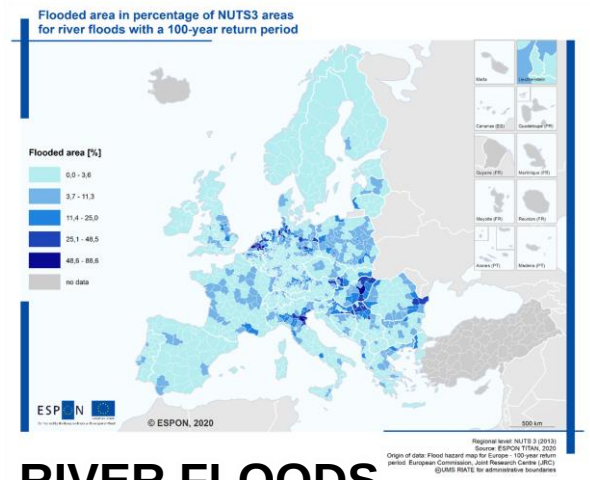
DROUGHTS

(LANDSLIDES)

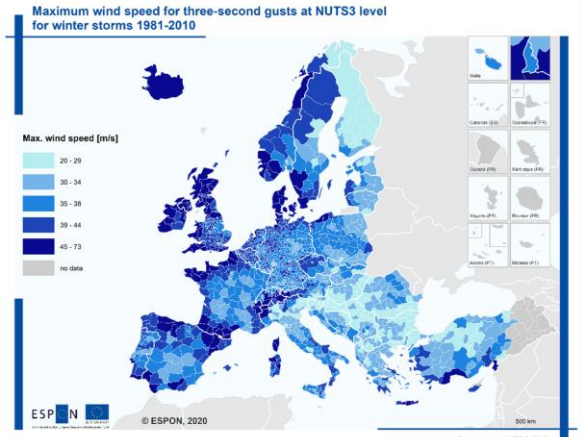


// ESPON-TITAN
(natural hazards patterns)

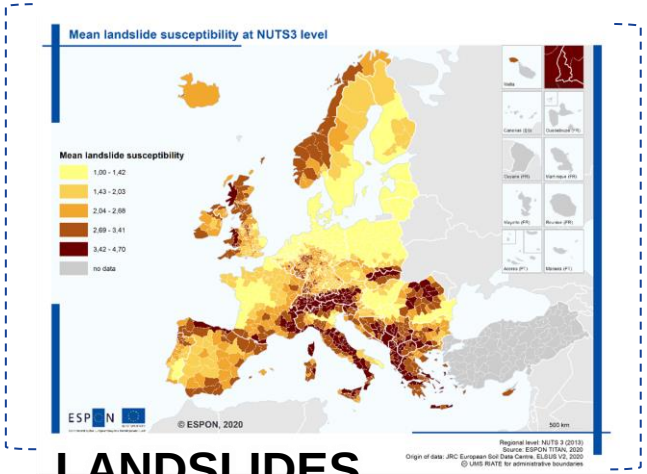
2.Natural Hazard Patterns



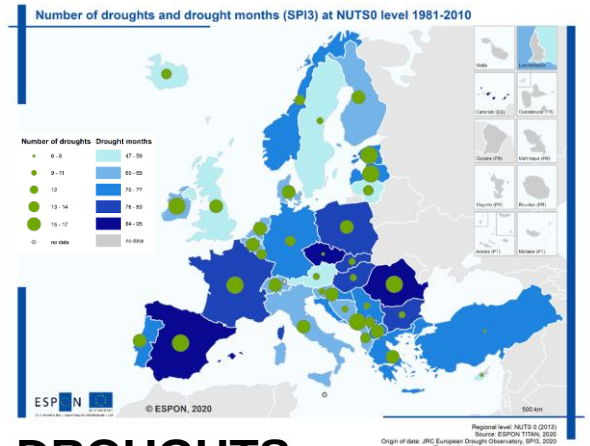
RIVER FLOODS



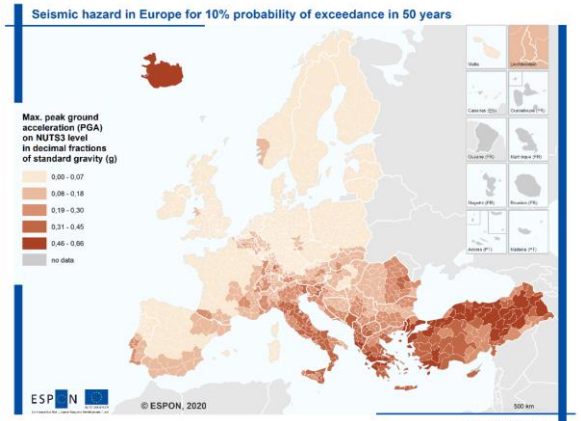
WINDSTORMS



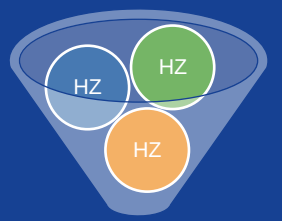
LANDSLIDES

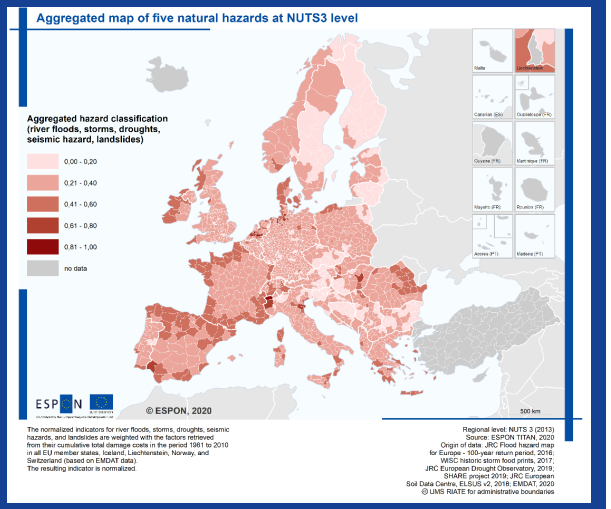


DROUGHTS



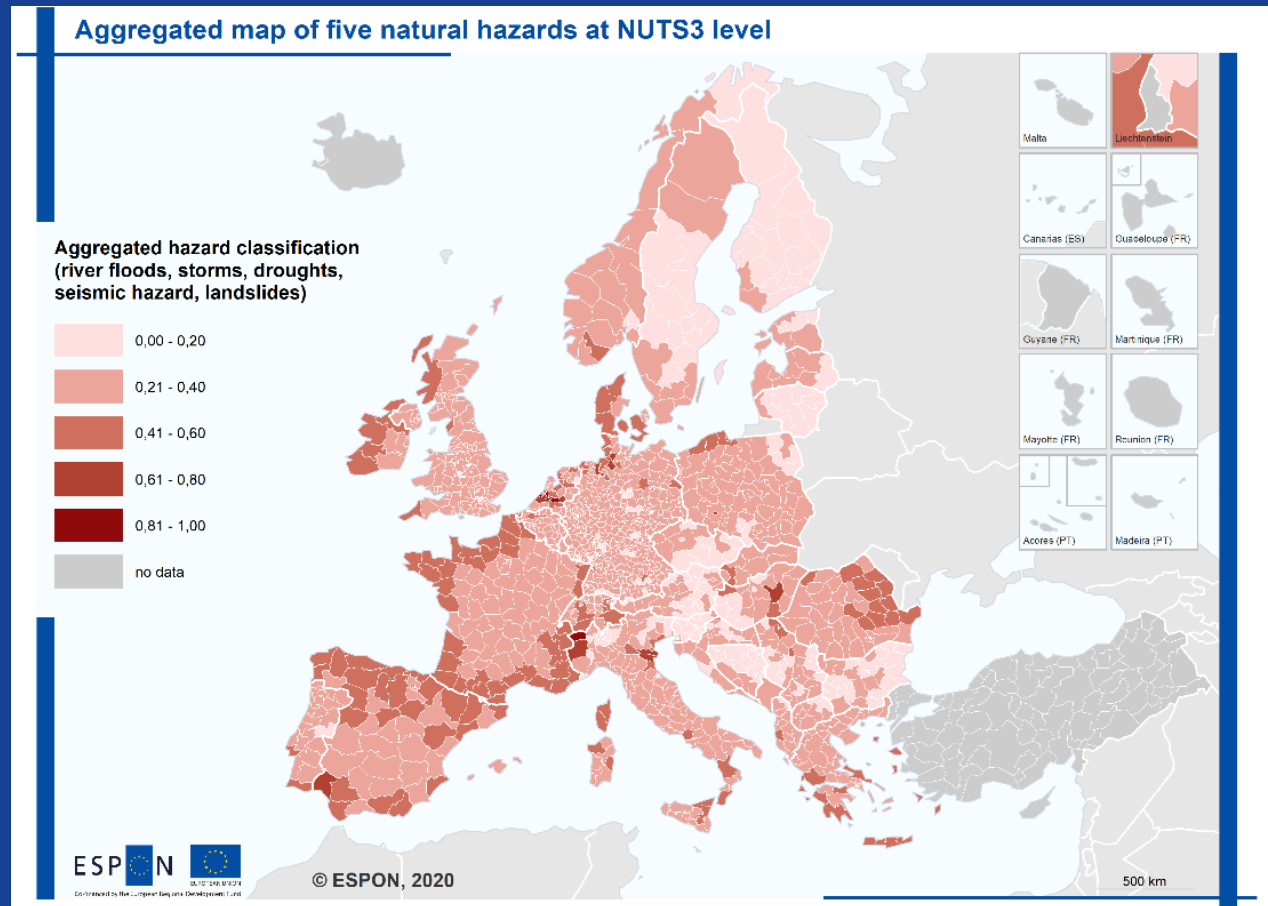
EARTHQUAKES





AGGREGATED HAZARDS

2.Natural Hazard Patterns, aggregated



consideration

- The relative weight of each chosen natural hazard was calculated by using the cumulative damage costs from Emergency Events Database (EM-DAT) + normalized

Hazard	Cumulative total damage costs 1981-2010 (in 2015 thousand of Euros)	Relative weight (%)
Winter storm	73.010.360	38,8
River flood	69.855.236	37,1
Drought	23.928.282	12,7
Earthquake	21.154.277	11,2
Landslide	262.597	0,1
Total	188.210.752	100,0

observation

- The aggregated hazard map does not respect any flood protection measures, some areas have a high aggregated hazard potential, meanwhile the effective risk is neglected.
- The drought potential is displayed on NUTS0, which partially leads to strong contrasts at national borders.
- It must be further considered that the weighting of the aggregation displays only economic damages, and not human fatalities or damages that cannot be expressed in monetary values.

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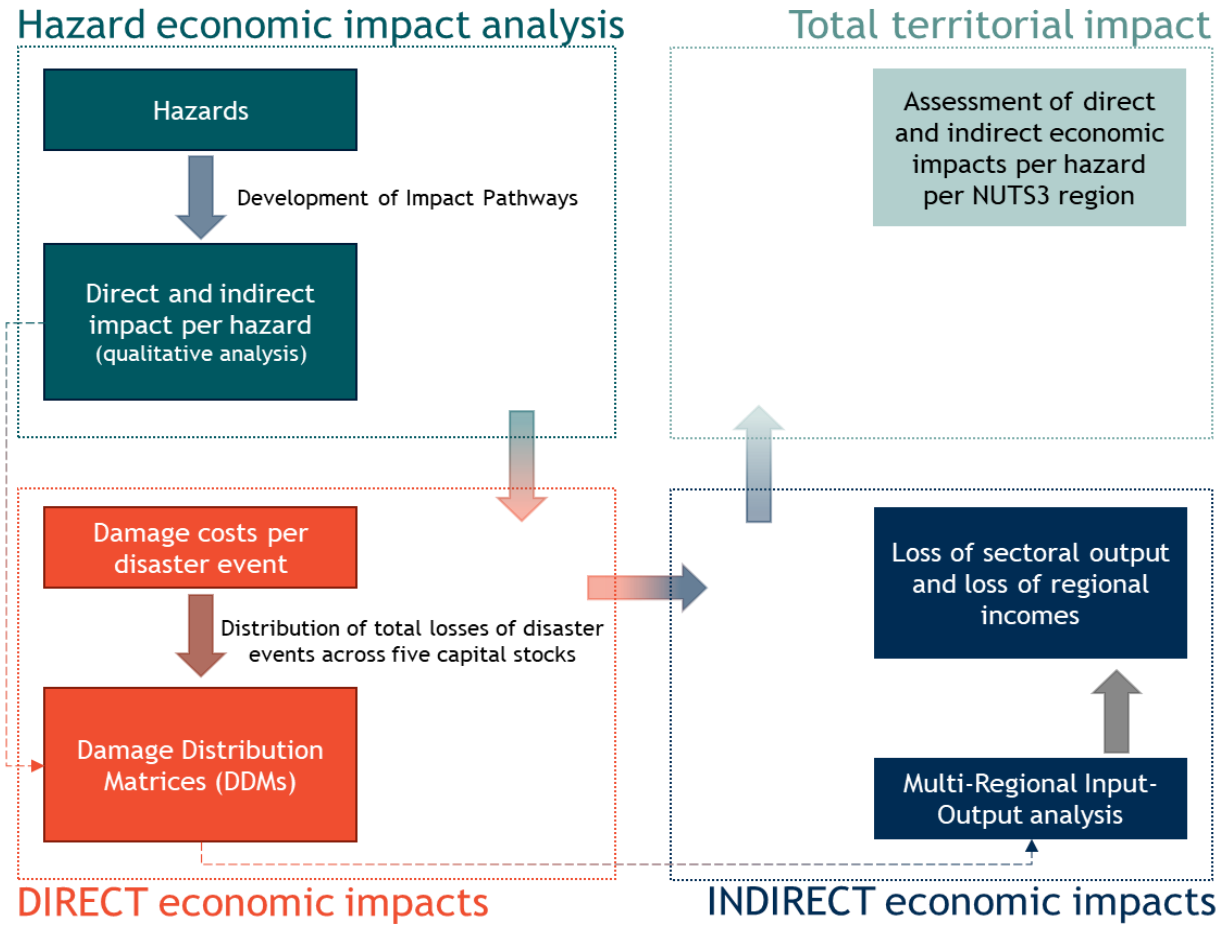
// ESPON-TITAN (economic impacts analysis)

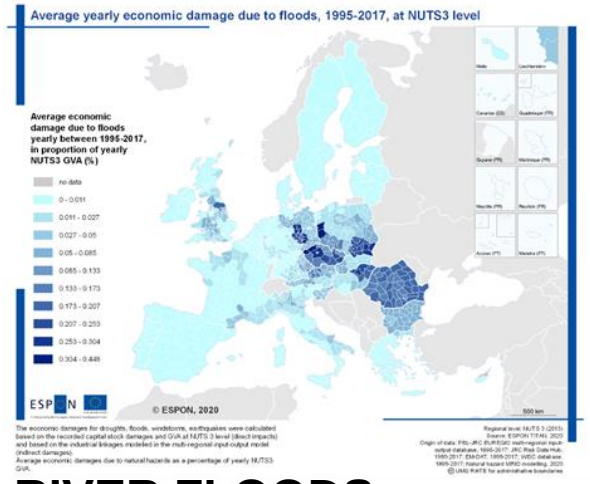
3.Economic Impacts Analysis, global

- Total economic impacts:
  - Direct (induced by direct damage to capital stock)
  - Indirect (induced by disruption of economic activities in other, linked regions)
- Global methodology (EU)
- Local methodology (FR, CZ)
- Publicly available sources (JRC Risk data hub, EM-DAT, WISC database…)

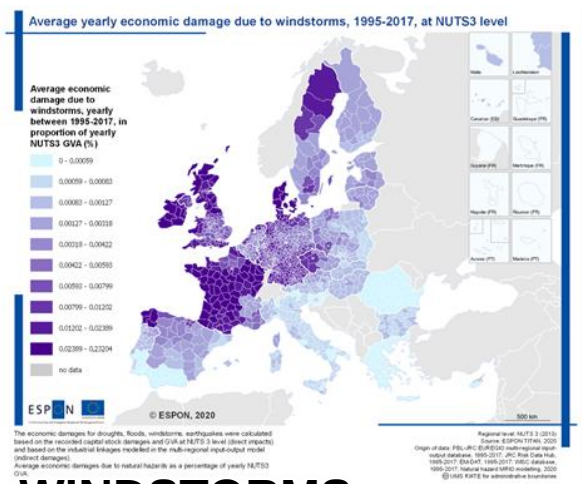


The direct and indirect economic impacts of the investigated hazards is provided by NUTS3 region by capital stock type

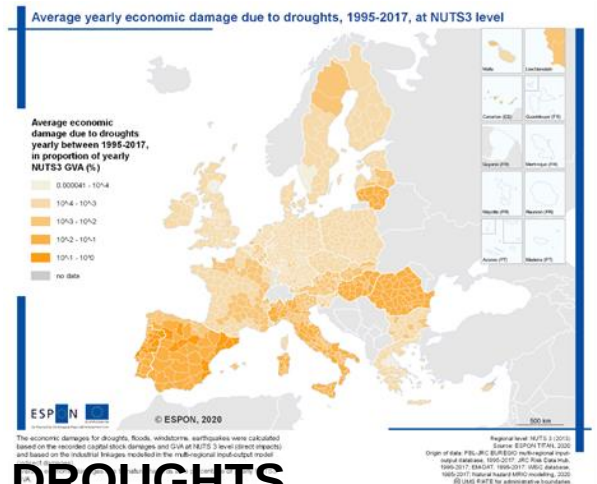
3.Economic Impacts Analysis, global



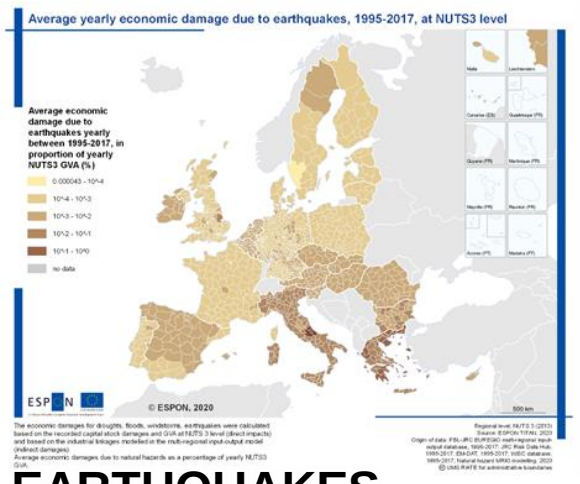
RIVER FLOODS



WINDSTORMS

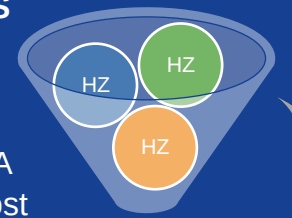


DROUGHTS

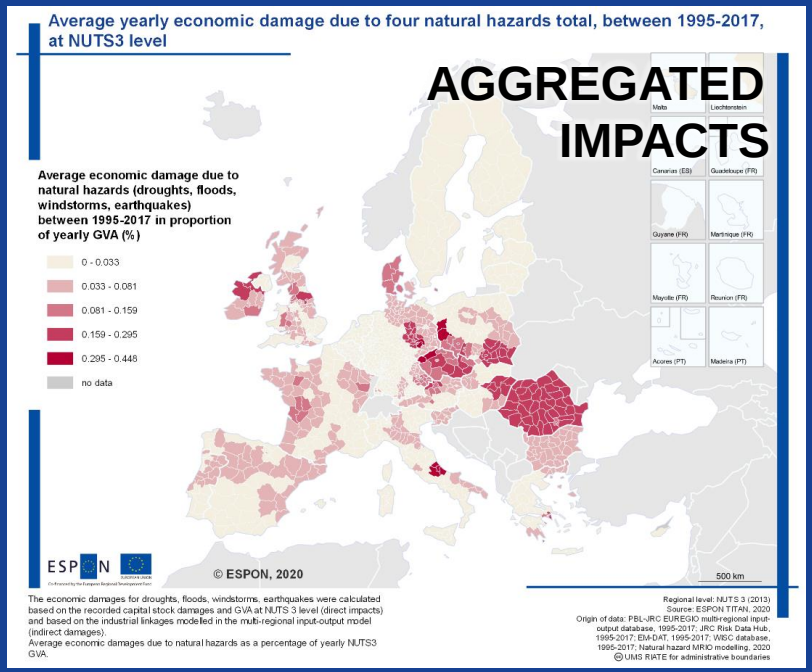


EARTHQUAKES

AVERAGE ECONOMIC IMPACTS OVER THE PERIOD 1995-2017

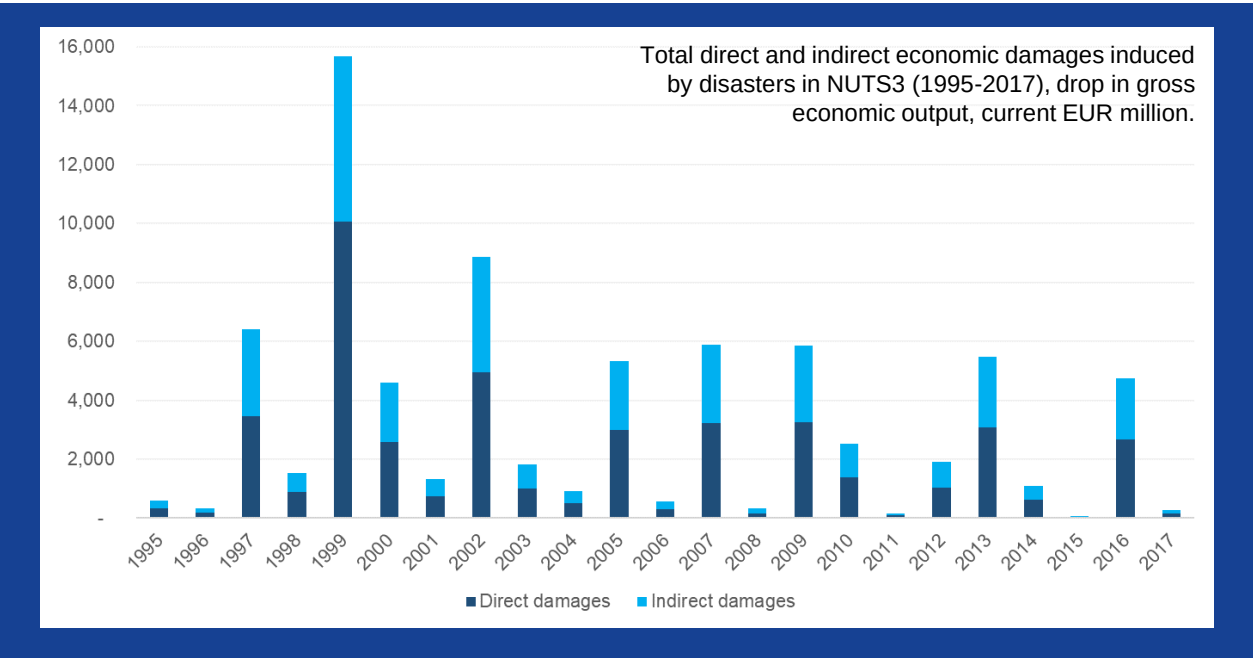


The maps capture the (negative) change of economic output to GVA ratio of the same region → the most heavily impacted regions are highlighted with darker colour.

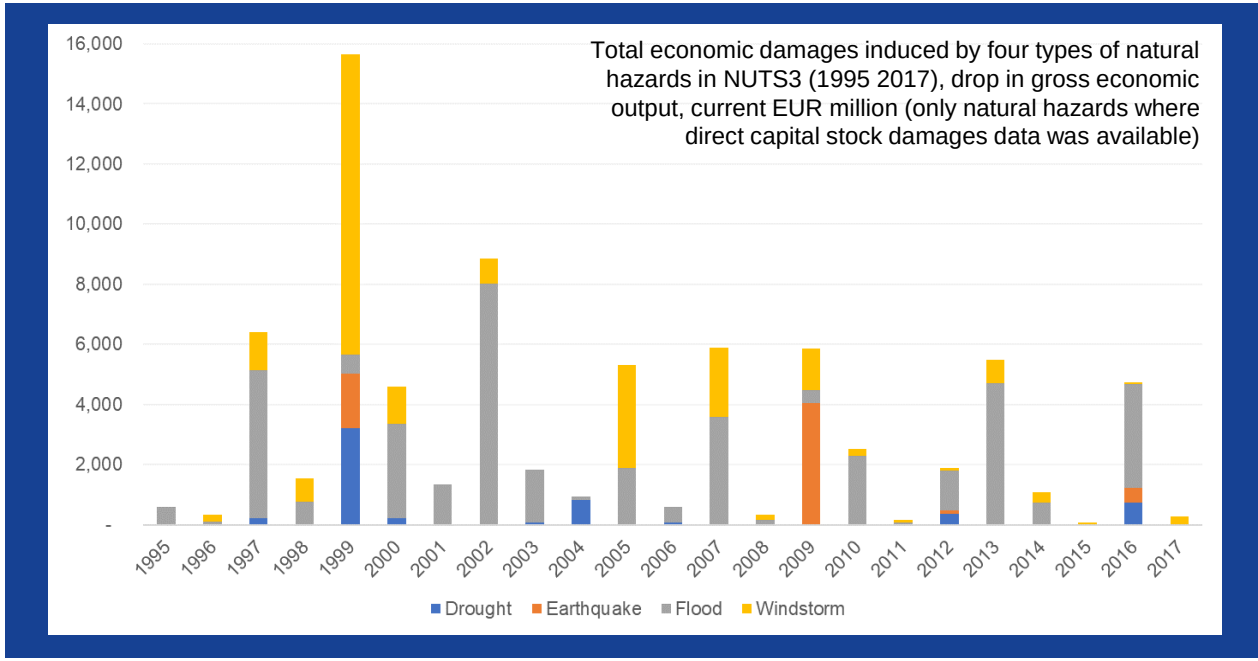


AGGREGATED IMPACTS

3.Economic Impacts Analysis, global

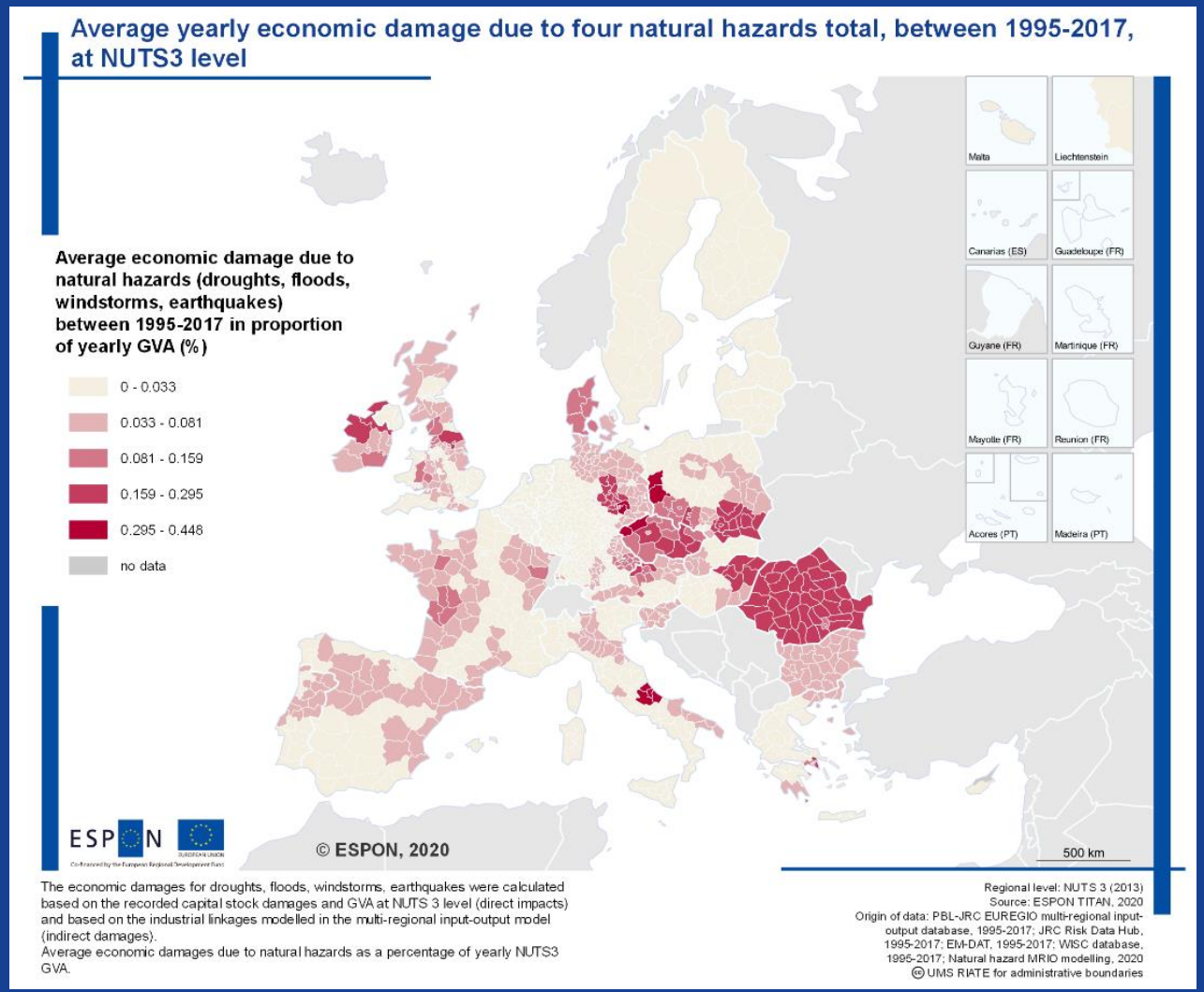


- Total direct economic impacts (EUR 43,8 billion) / Total indirect economic impacts (EUR 32,6 billion), over the period 1995-2017).
- Indirect economic impacts tend to be almost as large as direct impacts (ratio of 60% and 90% in all of the assessed years).
- The assessed impacts consider production losses and supply chains impacts – they do not account for potential interruptions of critical infrastructure (the real potential indirect losses could be even higher)



- Flood and windstorm events have had the largest negative impact on economic output in almost all analysed years.
- Quite reasonably (illustrated by the year 2009), heavy earthquake, despite being rare, tend to result in significant economic losses.
- Some NUTS3 regions across Europe tend to be more vulnerable to certain types of natural hazards, while other regions are less impacted.

3.Economic Impacts Analysis, global



interpretation

- Central, Eastern and Southern European countries tend to be more affected by these hazards.
- Some of the hazards (e.g.: windstorms) do not follow this pattern, rather are related to coastal or mountainous areas (partly due to the GVA being relatively lower)
- A certain event may cause a relatively larger damage, compared to their local GVA (recommended to derivate their own measures to mitigate their effects).
- Parts of the UK and Ireland, Denmark, France and Spain are also highly affected by one or more natural hazard event types (1995-2017).

considerations

- The map (1995-2017) shows yearly average economic damage due to the four natural hazard, aggregated (measured in terms of the ratio of economic output drop compared to GVA, in %).
- Aligned and coherent with other studies
- Do not consider potential interruptions of critical infrastructures (such as harbours, airports, bridges, TEN infrastructures, etc.) - so, the real potential indirect losses could be even higher;

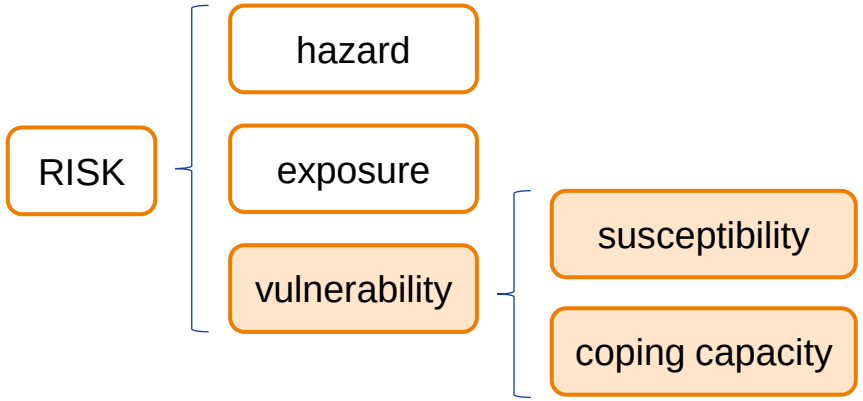
// ESPON-TITAN (vulnerability assessment)

5.Vulnerability assessment

Vulnerability matters. *The vulnerability helps us understand* ***why the occurrence of a natural hazard become a disaster.*** *The most vulnerable territories to disasters are located in Eastern Europe, Southern Europe and Baltic Region.*

- For the same level of hazard, the impact of disasters can vary considerably → explained by differences in vulnerability and exposure.

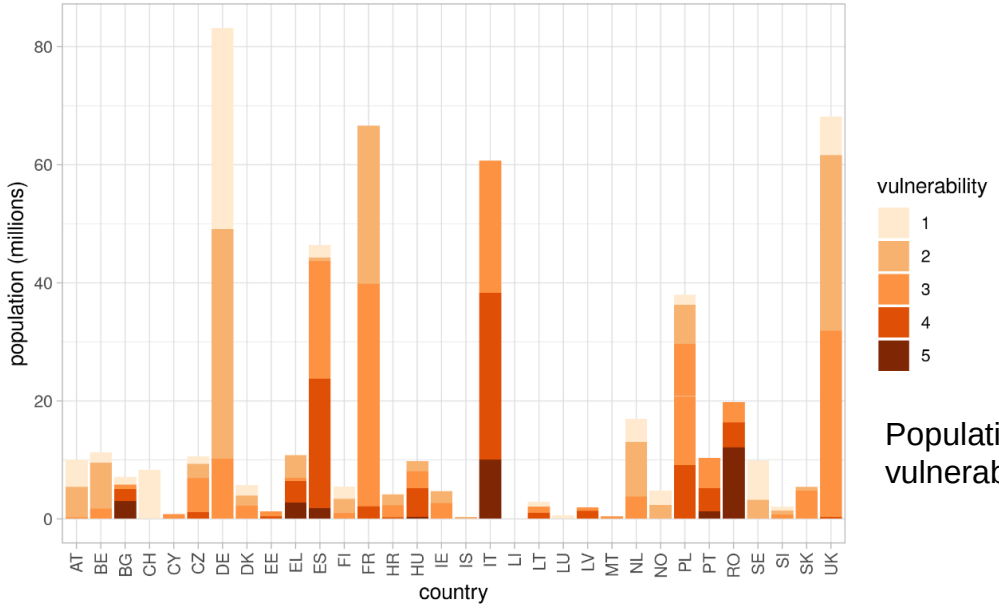
- The vulnerability of a territory is complex, depending on multiple dimensions (social, economic, demographic, environmental and governance).
- Holistic and integrative approach, due to the multiple dimensions involved, all contributing to territorial dynamics and thus spatially represented.



5.Vulnerability assessment

- The vulnerability assessment (PCA) considers 25 indicators:
  - 8 susceptibility (increase the territorial vulnerability)
  - 17 coping capacity (decrease the territorial vulnerability).

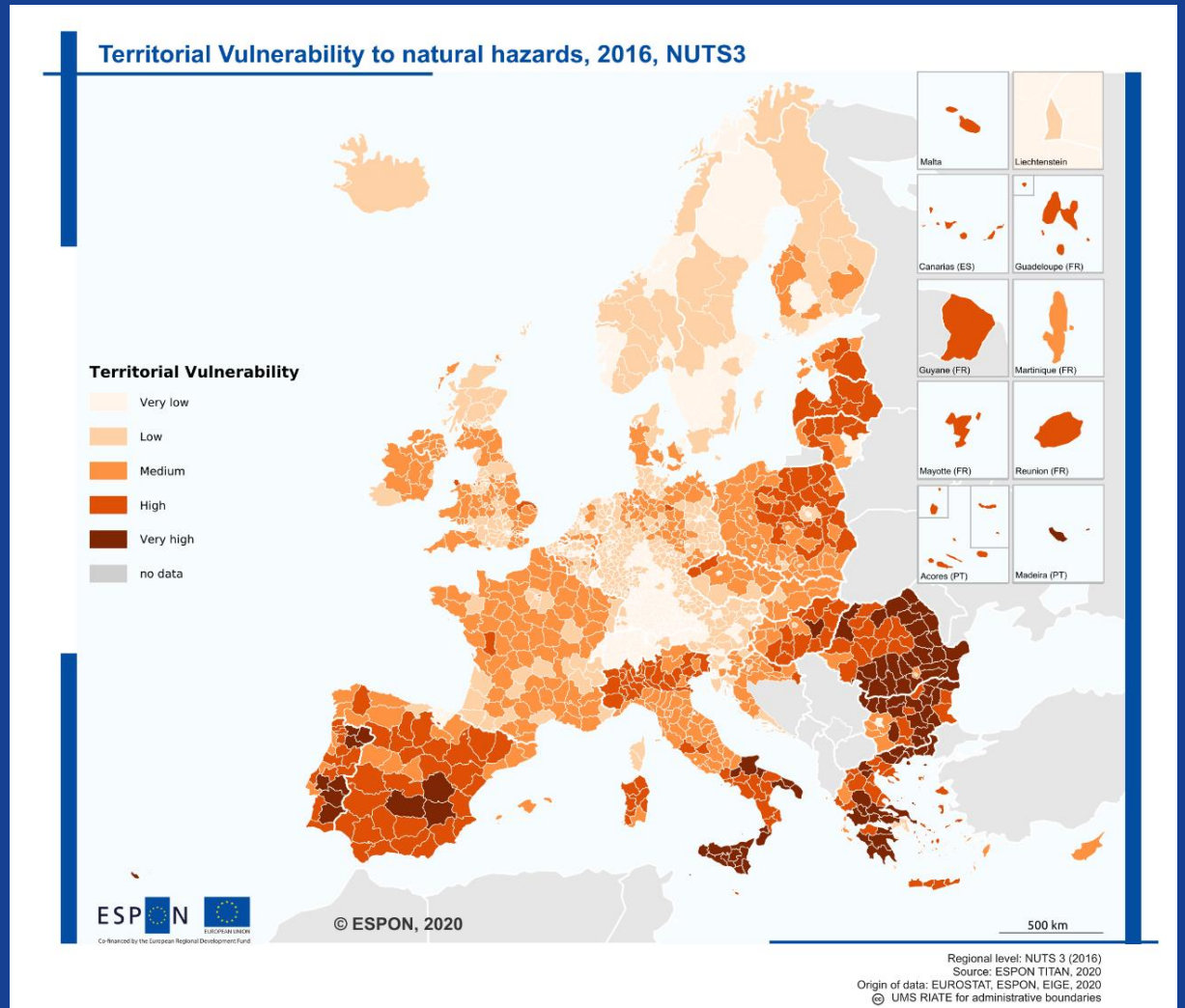
- The population living in territories with high/very high vulnerability sums 116 out of the 528 million (22%).



Population living in vulnerable territories

	Dimension	Indicator
susceptibility	Demography	Age of population
	Demography	Young-age dependency
	Demography	Old dependency
	Education and research	Early leavers from education and training
	Economy	Risk of Poverty and Social Exclusion
	Economy	Primary sector employments
	Economy	Unemployment rate
	Environment	Irrigable and irrigated areas
coping capacity	Demography	Natural population change
	Demography	Migration rate
	Education and research	Tertiary Educational Attainment
	Education and research	R&D expenditure
	Education and research	R&D personnel and researchers
	Education and research	Patent applications to the EPO
	Social capital and perception	Social capital
	Social capital and perception	Risk perception
	Health	Hospital beds
	Health	Practising physicians
	Economy	GDP per inhabitant
	Economy	Professional, scientific and technical employments
	Environment	Spatial distribution of GI
	Environment	Potential GI network for CC&DRR policies
	Gender	Gender equality index
	Governance	Quality of Government index
	Governance	Municipalities signatories to the Covenant of Majors

5.Vulnerability assessment



interpretation

- The territories to the east and south are more vulnerable to natural hazards.
- Certain areas in Hungary, Romania, Bulgaria, Greece, Italy, Spain and Portugal outstand.
- Some territories in Estonia, Latvia, Lithuania, Poland, France, and Czech Republic are also significantly vulnerable.

- The most vulnerable territories have a high susceptibility

(Early leavers from education and training, Unemployment rate and risk of poverty and Social exclusion).

- They also have a reduced coping capacity

(R&D expenditure, R&D personnel and researchers, Patent applications to the EPO, GDP per inhabitant, Professional, scientific, and technical employments, Social capital, Gender equality index and Quality of governance).

- Decreasing vulnerability of the territory may help to reduce the economic impact of natural disasters.

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// ESPON-TITAN (policy instruments)

6.Policy instruments on DRM and CCA

Several DRM and CCA instruments and good practices are identified at EU and national levels. Although progress has been made in risk assessment, ***the practice of DRM and CCA is still far from fulfilling the requirements for an effective spatial, risk-oriented management approach*** *that includes also the multiple dynamics of changing hazards, exposure and vulnerability.*

- Multi-methodological approach: A desktop analysis (focused on existing studies on DRM and CCA practices in Europe) + analysis of primary data from the case studies = summary on the practice of DRM and CCA.
- Good practices: risk management and climate adaptation practices encompass spatial planning measures and innovative approaches (e.g. inclusion of innovative governance structures into spatial planning)
- Case studies: (although context-dependent) identification and description of successful cooperation mechanisms, qualitative contexts of DRM and CCA, and an estimation of effectiveness of policies and instruments.
- Role of EU directives and their potential to support good and effective practice of DRM → European Green Deal, EU Strategy on Adaptation to Climate Change, Climate Law, EU Directives...

TITAN: Analysis of planning instruments

Country Code	relevant? (1 = yes)	ESPON countries Hazards	DRM - Assessment (assessment of hazards on national level and results: hazard maps, risk maps, multi-risk maps, reports)	DRM - Management (policies on national level: guiding decisions, strategies, programmes; way of integration into spatial planning: primary or secondary)	CCA - Assessment (assessment of climate change impacts on national level and results: impact maps, vulnerability maps, reports)	CCA - Management (policies on national level: guiding decisions, strategies, programmes; way of integration into spatial planning: primary or secondary)	Policies in general DRM/CCA	Good practice examples
EE		**Estonia (Estland)**			In 2015 the Estonian Environment Agency conducted a report of the climatic changes in the state, based on the	Climate Change Action Plan 2017 – 2020 (National Adaptation Plan) and Climate Change Adaptation		
EE	1	(1) Floods (river floods, storm surges)	The Floods Directive has been adopted in 2009 and since then a preliminary assessment of flood risks and flood risk	The Floods Directive has been adopted in 2009 and since then a preliminary assessment of flood risks and flood risk	Estonian Geological Survey is engaged in mineral resources and groundwater research, as well as geological mapping.	Mitigation plans aim to reduce the probability of flood occurrence and the extent of flood, provided that it is		
EE		(2) Droughts						
EE	1	(3) Storms (winter, convective)	Storms werden meist nur im Zusammenhang mit höherer Vulnerabilität gegenüber floods erwähnt. "Continuation of	At local level, the strong storm of 2005 in particular resulted in the development of detailed adaptation and action plans				
EE		(4) Earthquakes						
EE	1	(5) Others (flash floods, land slides)	N: Coastal flood/ Flash flood/ Storm convective/ Landslide/ Mudslide/ Avalanche	One of the goals for t… planning, including c…	…tal Monitoring …ics and coastal	"Estonian Environmental Strategy Until 2030" The framework of environmental protection and the		
EL	1	**Greece (Griechenland)**	Mainly responsible for the implementation of civil protection measures is the General Secretariat for Civil	A national framewor… planning is the "Xen…		The Ministry of Environment and Energy is responsible f… the development and implemental of environmetal		
EL	1	(1) Floods (river floods, storm surges)	The first River Basin Management Plan was adopted in 2009 and renewed in 2017. River basin districts have been	Das Sondersekretaria… Studien zum Hochwa…		Framework for Spatial Planning in Coastal zones (Elaboration by 2021: National Maritime Spatial Planning		
EL	1	(2) Droughts	A mapping effort initiated by the National Committee to Combat Desertification (NCCD) indicates that 34% of the	National Programme… Water Resources (Th…	…tional Observatory …rough	Since 1994 the national government has initiated aware… raising campaigns. With the aim of raising the storage		
EL		(3) Storms (winter, convective)						
EL	1	(4) Earthquakes	Seismic Risk Map is incorporated into the Hellenic Antiseismic Regulation of 2000, which was amended in 2003	Division of the Greek territory in seismic zones of different seismic hazard, based in the maximum expected horizontal	The first Greek Seismic Design Code was established in 1959 and was amended in 1985. Procedures for the renewal of	Earthquake Planning and Protection Organization (E.P.P. is a Legal Entity of Public Law under the supervision of t…		
EL	1	(5) Others (flash floods, land slides)	Forest fires: a **daily forest fire risk map** is issued by the General Secretariat for Civil Protection during the summer	Forest Cities is a project that strengthened the role of Greek local authorities in forest fire prevention, through the				
ES	1	**Spain (Spanien)**	**National Plan for the Prediction and Monitoring of Adverse Weather Events** by the Stage Agency of Meteorology		Impacts, Vulnerability and adaptation assessments: various have been carried out in Spain such as impact assessments	National Climate Change Adaptation Plan (Plan Naciona… Adaptación al Cambio Climático (PNACC)): reference		
ES	1	(1) Floods (river floods, storm surges)	Flood Risk Management Plans: for each of the 16 river basin districts Flood Risk Management Plans have been	Integration of spatial planning within flood risk management: The Spanish authorities listed the adoption of	A **risk and impact assessment for the climate change on the Spanish coasts** was conducted by the Ministry of Agriculture,	**National Strategy fo Sustainable Coastal Management:** T… main challenges identified for this strategy include		
ES	1	(2) Droughts	Spain participated in the MEDROPLAN (Mediterranean Drought Preparedness and Mitigation Planning) project,	**Drought Management Plans:** specific plans within the River Basin Management Plans and the River Basin Authorities are	The Ministry of Agriculture, Fish, Food and Environment (MAGRAMA) assessed the impacts of climate change on the	Water actions undertaken in Spain to tackle water scarci… Optimisation of irrigation infrastructure, desalination of…		
ES		(3) Storms (winter, convective)						
ES		(4) Earthquakes	The National Geographical Institute (IGN) hosts a website that visualises upcoming earthquakes and general seismic surveillance (Visualizador terremotos próximos). Besides the IGN publishes seismicity and hazard maps (available	**Special plans for seismic risks**: the plans will be prepared by those Autonomous Communities in whose territory earthquakes of equal or greater intensity than grade VI are foreseeable, corresponding to the iso-system of the seismic				
ES		(5) Others (flash floods, land slides)	NO: Coastal flood/ Avalanche *IMPORTANT: drought, earthquake + tsunami, riverine flood, flash flood, storm + tropical + extra tropical, storm convective,			*Urban planning and construction: first action lines to adaptate mitigation measures in this sector have been introduced in the National Adaptation Plan: basic studie…		

DRM/CCA Practices

Country Code	ESPON countries Hazards	National level (role of spatial planning in DRM)	Regional level (role of spatial planning in DRM)	Local level (role of spatial planning in DRM)	Good practice examples	Comments
AT	**Austria (Österreich)**					
AT	(1) Floods (river floods, storm surges)	The Austrian Conference on	The 2015 progress report on the	Integration of spatial planning	Clear integration of spatial planning	
AT	(2) Droughts					
AT	(3) Storms (winter, convective)					
AT	(4) Earthquakes					
AT	(5) Others (flash floods, land slides)					
BE	**Belgium (Belgien)**					
BE	(0) General information					
BE	(1) Floods (river floods, storm surges)					spatial planning is a priorized sector
BE	(2) Droughts					- Research and studies funded by
BE	(3) Storms (winter, convective)					
BE	(4) Earthquakes					
BE	(5) Others (flash floods, land slides)					
BG	**Bulgaria (Bulgarien)**					
BG	(1) Floods (river floods, storm surges)	Climate adaptation is considered in			Key land use, spatial planning,	
BG	(2) Droughts					

Role of Spatial Planning

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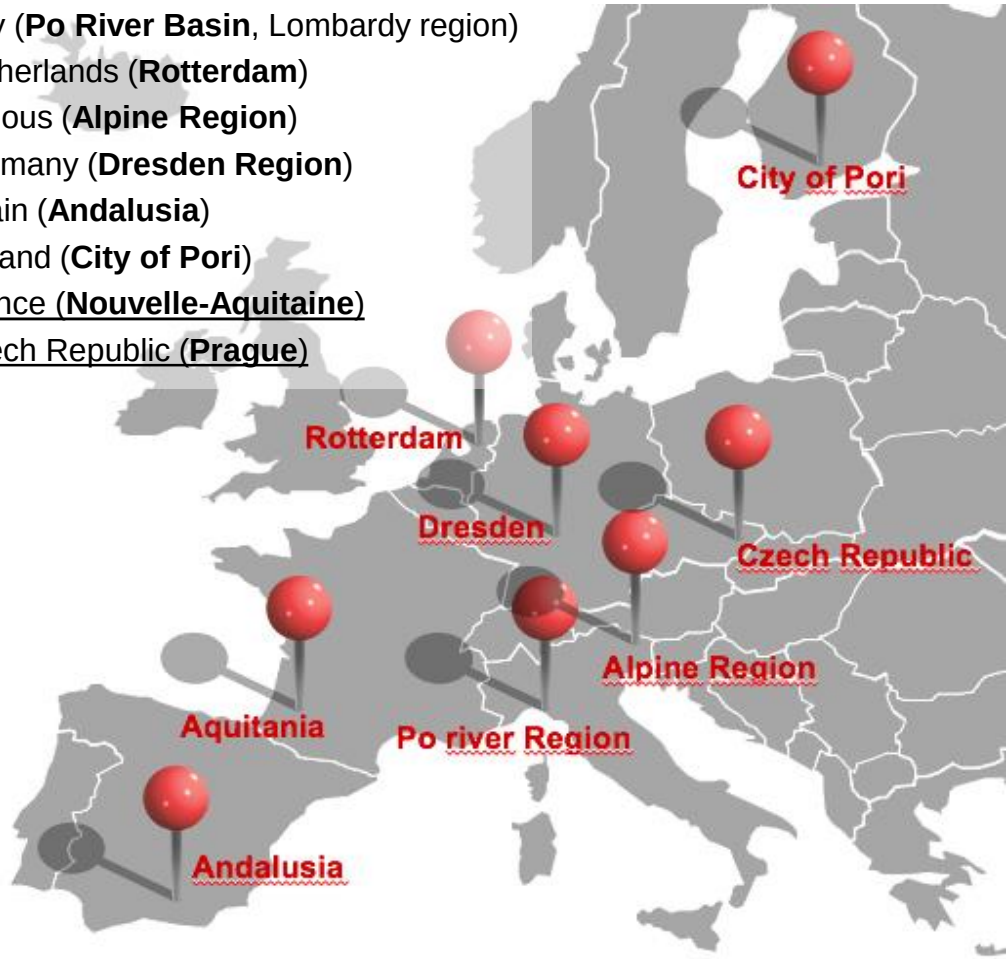
// ESPON-TITAN (case studies)

7.ESPON-TITAN Case studies

Understanding practice in context.

- 8 case studies investigated, representing different spatial, institutional and governance settings, with homogeneously geographical distribution.
  - Illustrate the findings in terms of natural hazard distribution, associated economic impacts and policy instruments in comparison to the analyses made for the European level
  - Contribute to the generation of policy recommendations focused on a better integration of DRM and CCA in Spatial Planning
- Stakeholder consultations (practice of DRM, implementation of CCA measures, relation to spatial planning, existing coordination and cooperation among entities, lessons learned, etc.)

- Italy (**Po River Basin**, Lombardy region)
- Netherlands (**Rotterdam**)
- Various (**Alpine Region**)
- Germany (**Dresden Region**)
- Spain (**Andalusia**)
- Finland (**City of Pori**)
- France (**Nouvelle-Aquitaine**)
- Czech Republic (**Prague**)



7. ESPON-TITAN Case studies

LESSONS LEARNED AND GOOD PRACTICES (I)

- Territories should focus on more risk prevention activities rather than response/reaction, as prevention has a relevant cost but is worth it.
- Risk cannot be avoided nor be reduced to zero, but managed. Thus, residual risk should be accepted and managed through sound preparation and DRM measures.
- New methodologies could be implemented for risk assessment as a basis for prevention policies (e.g.: flood prevention areas based on scenarios, instead of probability of occurrence).
- Importance of binding laws regulating every aspect of DRM, to be complemented with support of other administrative instruments (prevention, maintenance, update…).

7. ESPON-TITAN Case studies

LESSONS LEARNED AND GOOD PRACTICES (II)

- The regional and national level should offer to the local level financial support, guidelines and knowledge.
- Vertical coordination and cooperation are major for DRM and CCA, as well as intersectoral coordination, that should be improved (DRM/CCA cannot remain sectoral, but should be integrated with spatial planning and development programs).
- A sound strategy for DRM and CCA should involve all the relevant actors of the territory (professionals, universities, enterprises…).
- The supranational level should set common standards for DRM and CCA strategies within the EU (e.g.: Flood Risk Management Directive).

// ESPON-TITAN (policy recommendations)

8. Policy messages and recommendations

Context	Topics covered by the Policy Recommendation
Economic impacts	(A) How to improve methodologies for calculating the economic costs of natural hazards and assessing their impact at different territorial scales.
	(B) What could be done to improve data availability on economic losses associated with natural hazards, especially at local and regional levels.
Connection between economic losses and appropriate DRM and CCA measures	(C) How to link measurement of economic losses due to natural hazards with the development of appropriate disaster risk management and climate change adaptation measures at different territorial scales.
Improvement of DRM and CCA practices	(D) To what extent different funding mechanisms (European Structural and Investment Funds, Financial Instruments, etc.) can be better mobilised to further support disaster risk management and climate change adaptation at territorial level.
	(E) How should regions, cities and local governments cooperate to ensure the efficiency and coordination of various measures related to disaster risk management and climate change adaptation? What could be a role for different umbrella organizations?
	(F) How to better integrate DRM and CCA into legislative frameworks and instruments of territorial development?

Include methodological issues (future research)

Address different parts of the Policy Process

- Problem identification and agenda setting
- Formulation and adoption
- Implementation
- Evaluation

EU Level Experiences from Case Studies

8. Policy messages and recommendations

Economic Impacts (I)

Methodologies for calculating economic costs and impacts of natural hazards

Harmonisation of concepts and methods for risk assessment and risk evaluation

Research on **indirect losses** and impacts should increase

Conceptualisation of **criticality** as a basis for contributing to the evaluation of risk

Further develop of appropriate **damage functions** for different types of hazards including the calculation of uncertainty parameters

Support methodological innovations in risk assessments regarding the **spatial and temporal dimension of risk**

Support regions and the local level in using **research and cooperation projects** more strategically for DRM and CCA

8. Policy messages and recommendations

Economic Impacts (II)

Improve **data availability** on economic losses from natural hazards at local and regional levels

Development of a framework for the **collection of the necessary data** at the local level across Member States/authorities

Natural hazards related damage data and reporting **should be more granular, including the distinction between direct and indirect damages** to avoid double counting in economic modelling

8. Policy messages and recommendations

Connection between economic losses and appropriate DRM and CCA measures

Link measurement of economic losses with the development of DRM and CCA measures

DRM and CCA measures and plans should **account for the total economic impacts** of the occurring natural hazards, including both **direct and indirect losses** as well as **risk aversion** factors

Support a paradigm shift towards a **spatially oriented risk assessment and management** by including the spatial (cross-sectoral, multi-risk perspective) and temporal (risk dynamics, emerging risks) dimension of risk

Conceptualisation of criticality and **consideration of critical infrastructures in the evaluation of risk** (systemic risk/criticality perspective)

8. Policy messages and recommendations

Policy recommendations regarding the improvement of DRM and CCA practices (I)

Focused promotion of a **pro-active and prevention-oriented** design of EU funding instruments in combination with quality objectives regarding funding of reconstruction

Mobilise **European funding mechanisms** to further support DRM and CCA at territorial levels

8. Policy messages and recommendations

Policy recommendations regarding the improvement of DRM and CCA practices (II)

Cooperation and coordination of regions, cities and local governments

Develop **cooperation structures** between regions, cities and local governments but also between different experts based on a balanced set of formal and informal elements

Establish a clear **coordination** structure for DRM and provide it with **leadership** qualities

8. Policy messages and recommendations

Policy recommendations regarding the improvement of DRM and CCA practices (III)

Support DRM and CCA issues during amendment processes of EU Directives

Integration of DRM and CCA into legislative frameworks and territorial development

Mainstreaming **climate change adaption** in territorial development policies

8. Policy messages and recommendations

A) Methodologies for calculating economic costs and impacts of natural disasters	B) Improve data availability on economic losses from natural disasters at local and regional levels	C) Link measurement of economic losses with the development of DRM and CCA measures	D) Mobilise European funding mechanisms to further support DRM and CCA at territorial levels	E) Cooperation and coordination of regions, cities and local governments	F) Integration of DRM and CCA into legislative frameworks and territorial development
• A-1: **Harmonisation** of risk assessment and risk evaluation • A-2: Further develop **damage functions** for hazards • A-3: Research on indirect losses and **indirect** impacts • A-4: Innovations in risk assessments regarding the **spatial and temporal dimension** of risk • A-5: Conceptualization of **criticality** as a basis for contributing to the valuation of risk • A-6: More strategic use of **research and cooperation projects** for DRM/CCA	• B-1: Framework for **collection of necessary data** at the local level • B-2: More **granular** data and reporting, including distinction between direct and indirect damages	• C-1: DRM measures and CCA plans should **account for the total economic impacts** of the occurring natural hazards (incl. **direct and indirect** losses as well as **risk aversion** factors) • C-2: Spatially oriented risk assessment and management by **including the spatial and temporal dimensions** • C-3: Conceptualization of consideration of **critical infrastructures** in the evaluation of risk	• D-1: Promotion of a **pro-active and prevention-oriented** design of EU funding instruments	• E-1: Develop **cooperation structures** between regions, cities and local governments but also between DRM experts • E-2: Establish a clear **coordination** structure for DRM and provide it with **leadership** qualities	• F-1: **Support DRM and CCA** issues during amendment processes of EU Directives • F-2: Mainstreaming **climate change adaption** in territorial development policies

// ESPON-TITAN
(spin-off Portugal - SOPORT)

TITAN Spin-off Portugal: SOPORT

- Goal: Develop a Strategic Planning Framework proposal for the inclusion of adaptation measures to cope with forest wildfires impacts in a climate change context into existing Spatial Planning instruments in the Algarve Region, Portugal.

2020 SEPTEMBER

TASK 1 — Local Context Diagnosis

- governance and policy framework
- existing data related to forest fires
- stakeholders mapping
- supporting tools: calls, interviews, surveys

TASK 2 — Identification of key challenges

- vision and objectives- key challenges
- prioritization of challenges
- viability analysis
- collaborative approach

TASK 3 — Development of the Concept

- context EU-scale
- cross-analysis TITAN
- lessons to be shared
- proposal of feasible alternatives

TASK 4 — Strategic Planning Framework

- policy recommendations
- multilevel governance
- adaptation/mitigation measures

SEPTEMBER 2021

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Co-financed by the European Regional Development Fund

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// Thank you

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